DP IB Environmental Systems & Societies (ESS): HL

Your notes

8.1 Human Populations

Contents

Human Population Dynamics

Your notes

Demographic Variables

Inputs to human populations: births and immigration

- Births and immigration are inputs that contribute to the growth of a population
- **Crude birth rate (CBR)**:
  - This is the number of live births per 1 000 people in a population per year
    - For example, a CBR of 15 means 15 babies are born for every 1 000 people in that population each year
  - CBR is calculated by dividing the total number of live births in a year by the total population and then multiplying by 1 000

$$CBR = \frac{total\ number\ of\ live\ births}{total\ population} \times 1\ 000$$

Worked Example

A country has 25 000 live births in a year, and the total population is 500 000.

Calculate the crude birth rate.

Answer

CBR = (number of live births / total population) x 1 000

CBR = (25 000 / 500 000) x 1 000

CBR = 50 births per 1 000 individuals

- **Immigration rate**:
  - This is the number of immigrants per 1 000 people in a population per year

Outputs from human populations: deaths and emigration

- Deaths and emigration are outputs that reduce the size of a population
- **Crude death rate (CDR)**:

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- This is the number of deaths per 1 000 people in a population per year
  - For example, a CDR of 8 means 8 people die for every 1 000 people in that population each year
- CDR is calculated by dividing the total number of deaths in a year by the total population and then multiplying by 1 000

$$CBR = \frac{total\ number\ of\ deaths}{total\ population} \times 1\ 000$$

Worked Example

In a given year, a country recorded 15 000 deaths, and the total population is 750 000.

Calculate the crude death rate.

Answer

CDR = (number of deaths / total population) x 1 000

CDR = (15 000 / 750 000) x 1 000

CDR = 20 deaths per 1 000 individuals

- **Emigration rate**:
  - This measures the number of people leaving a population per 1 000 people per year

Quantifying population dynamics

- Population growth and decline can be quantified through several key measures:
- **Total fertility rate (TFR)**:
  - This is the average number of children a woman is expected to have during her lifetime, based on current age-specific fertility rates
    - In developing countries, TFR tends to be higher (e.g. due to limited access to family planning)
  - TFR is calculated by summing the age-specific fertility rates (ASFR) and multiplying the result by five

$$TFR = \sum ASFR \times 5$$

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Worked Example

A country has the following fertility rates per 1 000 women in each age group:

- 15–19 years: 20 births per 1 000 women
- 20–24 years: 85 births per 1 000 women
- 25–29 years: 100 births per 1 000 women
- 30–34 years: 80 births per 1 000 women
- 35–39 years: 40 births per 1 000 women
- 40–44 years: 10 births per 1 000 women
- 45–49 years: 2 births per 1 000 women

Calculate the total fertility rate.

Answer

TFR = (20 + 85 + 100 + 80 + 40 + 10 + 2) x 5

TFR = 1 685 births per 1 000 women

TFR = 1.685 children per woman

This means that, on average, a woman in this country is expected to have approximately 1.69 children over her lifetime based on current fertility rates.

- **Life expectancy**:
  - This is the average number of years a person is expected to live from birth, assuming current demographic factors (such as healthcare) remain the same
- **Doubling time (DT)**:
  - This is the number of years it would take a population to double in size, based on its current growth rate
  - DT is calculated using the 'rule of 70': divide 70 by the population growth rate percentage

$$DT = \frac{70}{growth\ rate\ \%}$$

Worked Example

A population has a growth rate of 2% per year.

Calculate the doubling time.

Answer

DT = 70 / growth rate

DT = 70 / 2

DT = 35 years

- **Natural increase rate (NIR)**:
  - This is the difference between the crude birth rate and crude death rate, usually expressed as a percentage or a number per 1 000.
    - If the birth rate is higher than the death rate, natural increase occurs
  - NIR is calculated by subtracting the CDR from the CBR and then dividing the result by 10

$$NIR = \frac{(CBR - CDR)}{10}$$

Worked Example

A country has a CBR of 25 births per 1 000 individuals and a CDR of 10 deaths per 1 000 individuals.

Calculate the natural increase rate.

Answer

NIR = (CBR - CDR) / 10

NIR = (25 - 10) / 10

NIR = 1.5%

Examiner Tips and Tricks

Make sure you can define terms like crude birth rate, fertility rate and life expectancy. These often come up in exam questions.

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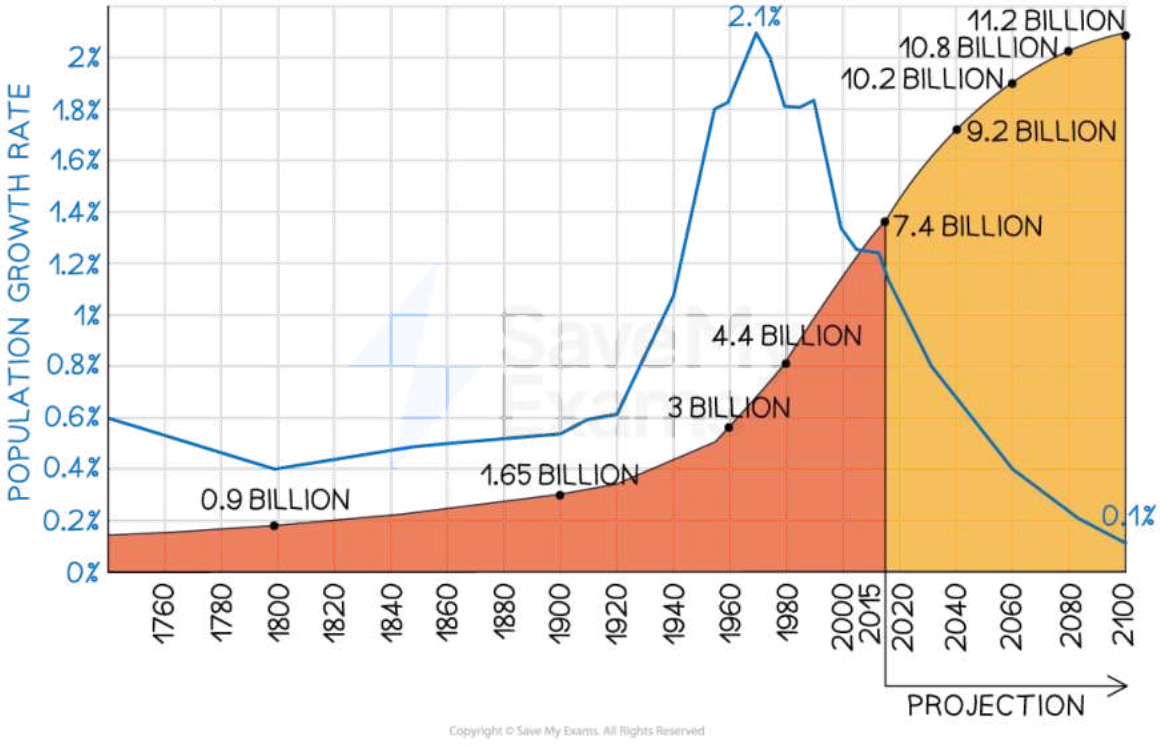
Human Population Growth

Rapid growth of the global human population

Your notes

- The global human population has followed a **rapid growth curve**, particularly in the past century
  - The global human population grew very slowly until 18th century
  - From 10 000 BCE to 1700 CE, the average growth rate was just 0.04% per year
  - There has been exponential growth in the global human population since the mid 18th century
  - In 1800, the world population was about 1 billion
  - By 2024, the population will have grown to over 8 billion
  - This growth is largely due to improvements in **medicine**, **agriculture** and **technology**, which have reduced death rates
- The growth rate is starting to fall again
- However, the world population is projected to continue to grow until approximately 2100, when it could reach more than 11 billion



World population total and growth rate, 1750–2015 (with projections until 2100)

Models to predict future global population growth

- **Population models** are used to predict the growth of the human population in the future
  - These models take into account **birth rates**, **death rates**, **fertility rates**, and **migration**
  - Models can help policymakers understand trends and make decisions about resource use, healthcare and urban planning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UN projection models

- The United Nations (UN) uses models to project future global population growth, offering **three different scenarios**:
  1. **High-fertility scenario**: assumes higher birth rates will continue, leading to a more rapid population increase
  2. **Medium-fertility scenario**: assumes a steady decline in fertility rates, leading to moderate population growth (this is the most likely scenario)
  3. **Low-fertility scenario**: assumes fertility rates will drop significantly, leading to slower growth or a shrinking population
- By 2100, the global population is projected to be around **9.7 billion** in the medium-fertility scenario

Uncertainty of future fertility rates

- Predicting **fertility rates** is challenging, leading to **uncertainty** in population forecasts
  - Changes in **cultural norms**, **economic conditions**, and **government policies** can all influence fertility rates
- Countries that went through **Industrial Revolutions** in the 18th and 19th centuries experienced **rapid population growth**
  - Today those countries are **developed** and their growth rates have **fallen**
  - In some cases, they have fallen so much that their total populations are in **decline** (e.g. Japan)
- The fastest population **growth** today occurs in **developing** countries that are **rapidly industrialising**

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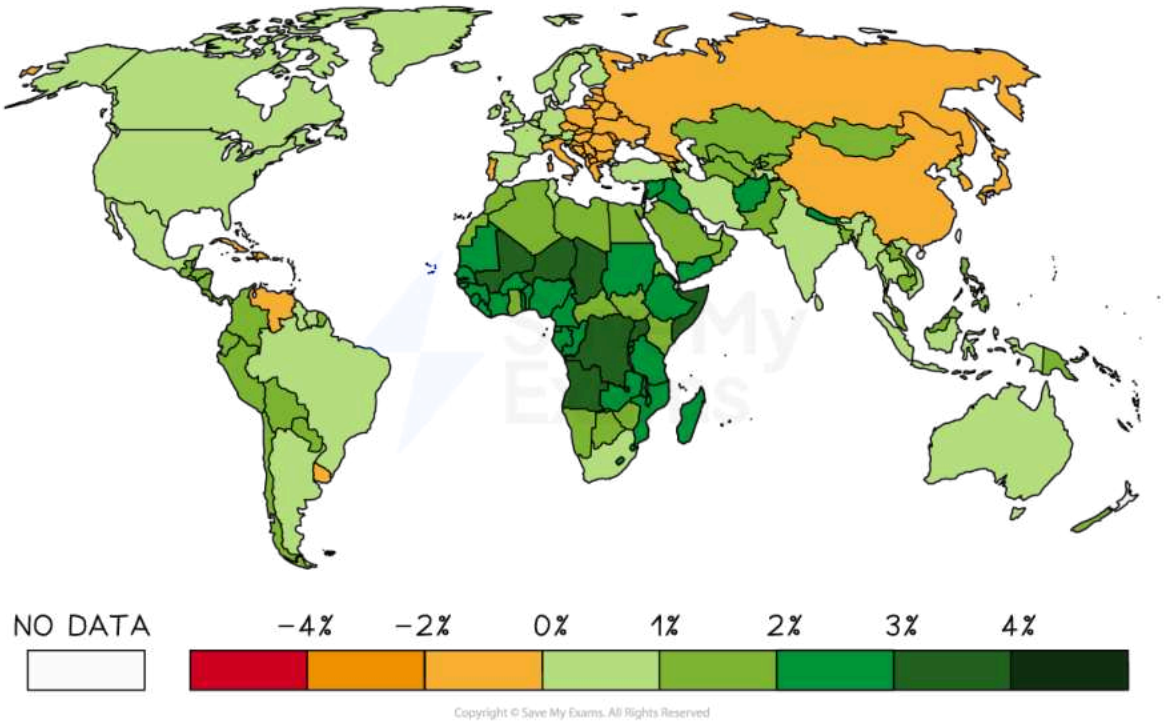

Global pattern of population growth rate (2021)

Managing Human Population Growth


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Direct Management of Population Growth

- **Population management** involves policies aimed at influencing the size, growth and distribution of human populations
  - These policies focus on **birth rates** (pro-natalist or anti-natalist) or on **migration** (immigration and emigration).
  - Governments use these policies to address concerns such as:
    - Overcrowding
    - Economic demands
    - Ageing populations

Anti-natalist policies

- Anti-natalist policies **reduce birth rates** in countries with high population growth
  - These policies are common in countries facing **overpopulation**, where resources are strained

Methods used

- **Education and awareness**: promoting smaller family sizes and the benefits of fewer children
  - For example, **China's One-Child Policy** (introduced in 1979) aimed to slow population growth by limiting families to one child
- **Access to contraception**: improving the availability of birth control methods to reduce unwanted pregnancies
  - For example, in **India**, family planning campaigns have included the distribution of free contraceptives
- **Financial incentives**: offering financial rewards or penalties to influence family size
  - For example, **Vietnam's Two-Child Policy** (introduced in the 1980s) aimed to limit family size by encouraging people to have only two children
  - The policy was supported by:
    - Financial penalties for larger families
    - Incentives such as preferential housing and education benefits for those who complied

Outcomes

- Anti-natalist policies lead to:
  - Slower population growth
  - Reduced pressure on resources
- However, they can also cause **long-term issues**, such as an ageing population (fewer young people to support the elderly)

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Pro-natalist policies

- Pro-natalist policies encourage an **increase in birth rates** in countries with low or negative population growth
  - These policies are used in countries facing **ageing populations** or **labour shortages**

Methods used

- **Financial incentives**: offering parents monetary support for having more children
  - For example, **France's Code de la Famille** (1939) offers cash bonuses, paid parental leave and subsidised childcare to encourage larger families
- **Parental support**: providing benefits such as **longer parental leave** or free childcare
  - For example, **Sweden** offers generous parental leave (up to 480 days shared between both parents) to support family growth
- **Cultural encouragement**: promoting family-friendly values through campaigns or media

Outcomes

- Pro-natalist policies help to:
  - Boost population growth
  - Ensure a balanced ratio between working-age individuals and the elderly
- However, they may **take time** to show effects and could face **cultural resistance**

Migration policies

- Migration policies manage **immigration** (inward) and **emigration** (outward) to influence population size and labour markets
  - Countries may encourage or restrict migration based on economic needs and population growth goals

Methods used

- **Open immigration policies**: allowing more people to enter the country, particularly if there is a need for workers
  - For example, **Germany** has encouraged immigration to offset its declining population and labour shortages
- **Restrictions on immigration**: limiting the number of people who can enter a country to control population growth or preserve jobs for citizens
  - For example, **Australia** has a strict immigration policy based on points
    - This points-based system favours skilled workers
- **Encouraging emigration**: some countries promote emigration to relieve population pressure


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Outcomes

- **Immigration** can help to:
  - Balance an ageing population
  - Provide labour
  - Diversify the economy
- **Emigration** can reduce population pressure, but may lead to a **'brain drain'**, where skilled workers leave the country

Examiner Tips and Tricks

Make sure you are aware of the potential long-term effects of anti-natalist, pro-natalist and migration policies, such as ageing populations or labour shortages.

Indirect Management of Population Growth

- **Indirect population management** involves policies that do not directly aim to control population growth but still affect factors such as birth rates, death rates and migration
  - These policies focus on **economic**, **social**, **health and development** areas
  - These policies indirectly influence population dynamics

Economic policies

- Economic policies influence population growth by:


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  - Improving living standards
  - Changing family planning decisions
- In less wealthy societies, families feel **economic pressure** to have **more children** because:
  - **Children contribute to family income**: in many rural or low-income areas, children may work on farms or help with small businesses, providing extra income for the family
  - **Lack of social welfare**: without government support like pensions or healthcare, parents may rely on their children to support them in old age
  - **Higher child mortality rates**: in areas with poor healthcare, parents may have more children to ensure that some survive to adulthood
  - **Limited access to education**: with fewer opportunities for higher education, children are often seen as a source of immediate labour and support, rather than an investment for the future
- **Wealthier societies** tend to have **lower birth rates**, as families may prefer to invest more in fewer children

Methods used

- **Job creation and economic stability**: improved employment opportunities can reduce poverty
  - This leads to fewer children as families focus on education and careers
- **Welfare systems**: governments that provide strong social welfare systems help families feel secure with fewer children

Outcomes

- **Higher living standards** often lead to lower birth rates, as families feel less economic pressure to have many children
- **Economic development** can slow population growth as people focus more on career and lifestyle choices over family size

Social and gender equality policies

- Policies that promote **gender equality** and **social development** indirectly reduce birth rates
  - This is because these types of policies empower women to make informed family planning decisions

Methods used

- **Education for girls and women**: increasing access to education leads to delayed marriages and childbirth, as well as smaller family sizes
- **Workforce participation**: encouraging women to join the workforce allows them to focus on careers

- This often leads to smaller families and later pregnancies

Outcomes

- **Improved gender equality** leads to more choices for women, resulting in lower birth rates
- Societies with **greater gender equality** have higher levels of education and economic participation, both of which can reduce population growth

Public health and welfare policies

- Health policies affect population growth by lowering death rates and improving overall well-being
  - Both of these can influence birth rates

Methods used

- **Improved healthcare**: providing better healthcare, especially maternal and child health services, reduces infant mortality
  - This can lead to smaller family sizes

Outcomes

- **Better healthcare** reduces both death and birth rates, leading to more stable population growth

Examiner Tips and Tricks

Make sure you are able to differentiate between **direct** and **indirect policies**. Direct policies, like **China's One-Child Policy**, explicitly target birth rates, while indirect policies, like **improving girls' access to education** in countries like Bangladesh, influence population growth through broader social changes.

Your notes

Your notes

Human Population Models

Age-sex pyramids

- The composition of human populations can be modelled and compared using **age-sex pyramids**
  - These are sometimes referred to as population pyramids, age-gender pyramids or age structure diagrams
- An age-sex pyramid is a graphical representation of a population's **age and sex structure**
  - It displays the percentage or number of individuals in each age group and gender within a given population
  - They typically show data for a particular country or region
- The age-sex pyramid is usually represented as a horizontal bar graph
  - The **age groups** are displayed along the **vertical axis**
  - The percentage or **number of individuals** in each age group is displayed along the **horizontal axis**
  - The **left** side of the graph displays the **male** population
  - The **right** side shows the **female** population
- The **shape** of the age-sex pyramid can provide **insights** into the demographic characteristics of a population
  - For example, a pyramid with a broad base and a narrow top indicates a young population with high fertility rates and low life expectancy
  - Whereas a pyramid with a narrow base and a broad top indicates an ageing population with low fertility rates and high life expectancy

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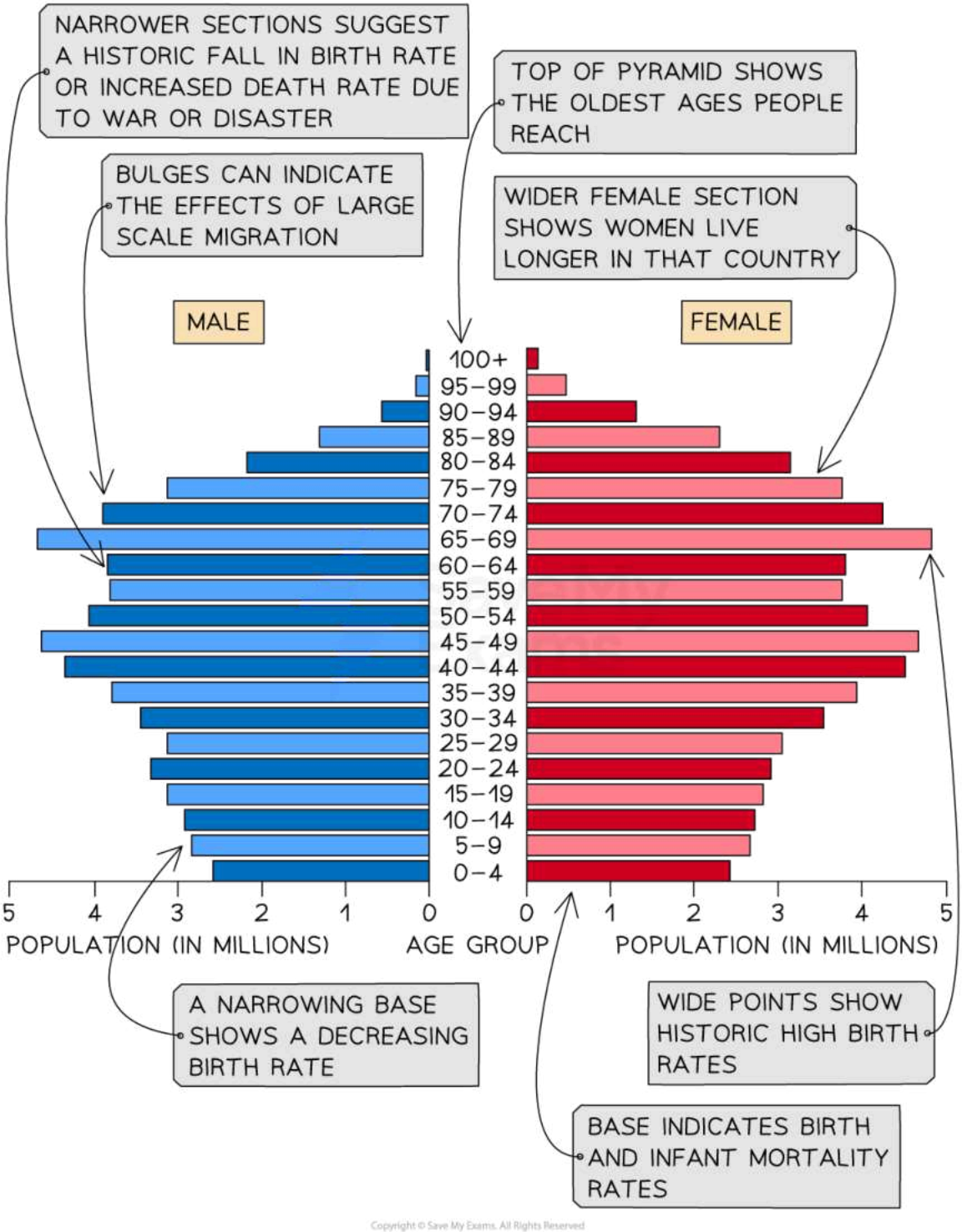

An example of a population pyramid

- Age-sex pyramids are used by policymakers and economists to:
  - Understand **population trends**
  - Forecast **future population growth**
  - Plan for social and economic policies
- They are also used in fields such as public health, education and social welfare to plan for the needs of specific age groups within a population
  - This means that governments can estimate and plan for spending
- An age-sex pyramid can be used to identify the following groups:
  - Young dependents
  - Old dependents
  - Economically active (working population)


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Population structures of LICs and HICs

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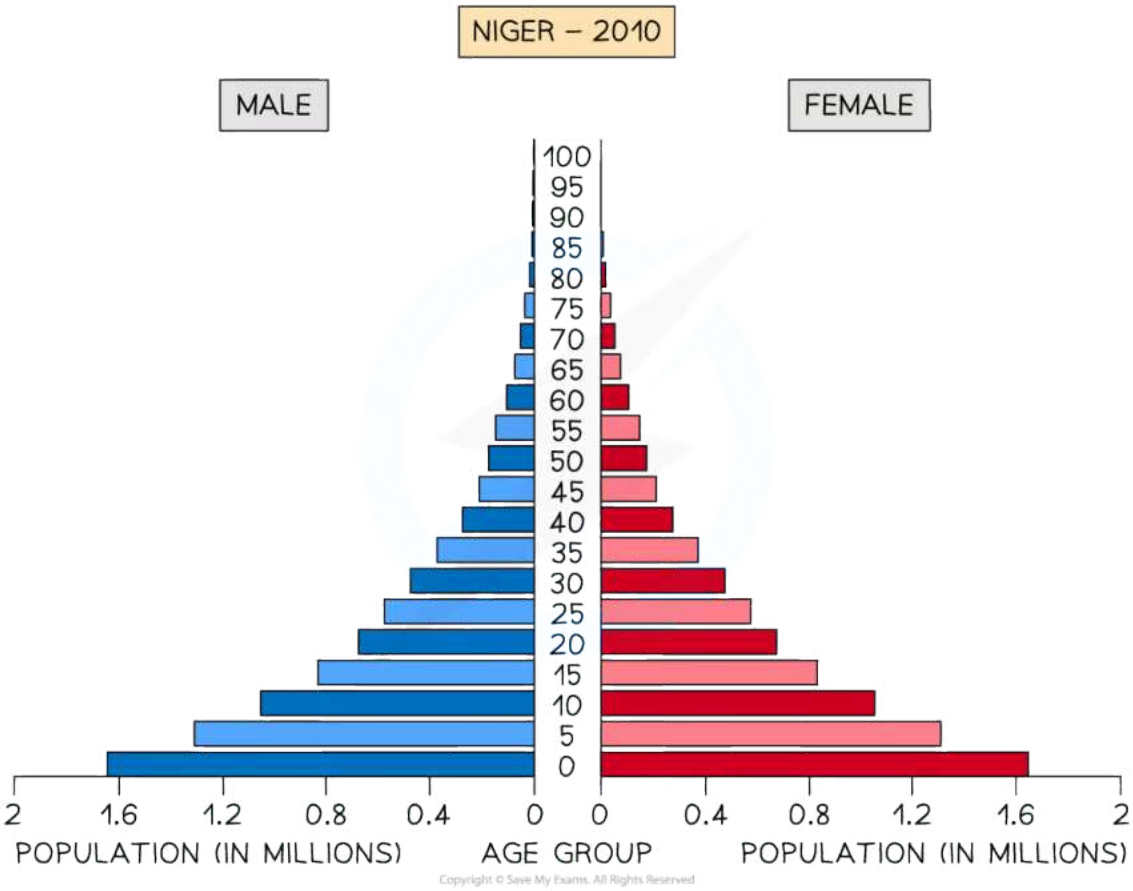

Age-sex pyramid for Niger

- **Low-income countries** (LICs) like Niger typically have a concave pyramid shape
- This indicates:
  - High birth rate
  - Low life expectancy
  - High death rate
  - High infant mortality rate
  - Young dependent population dominates

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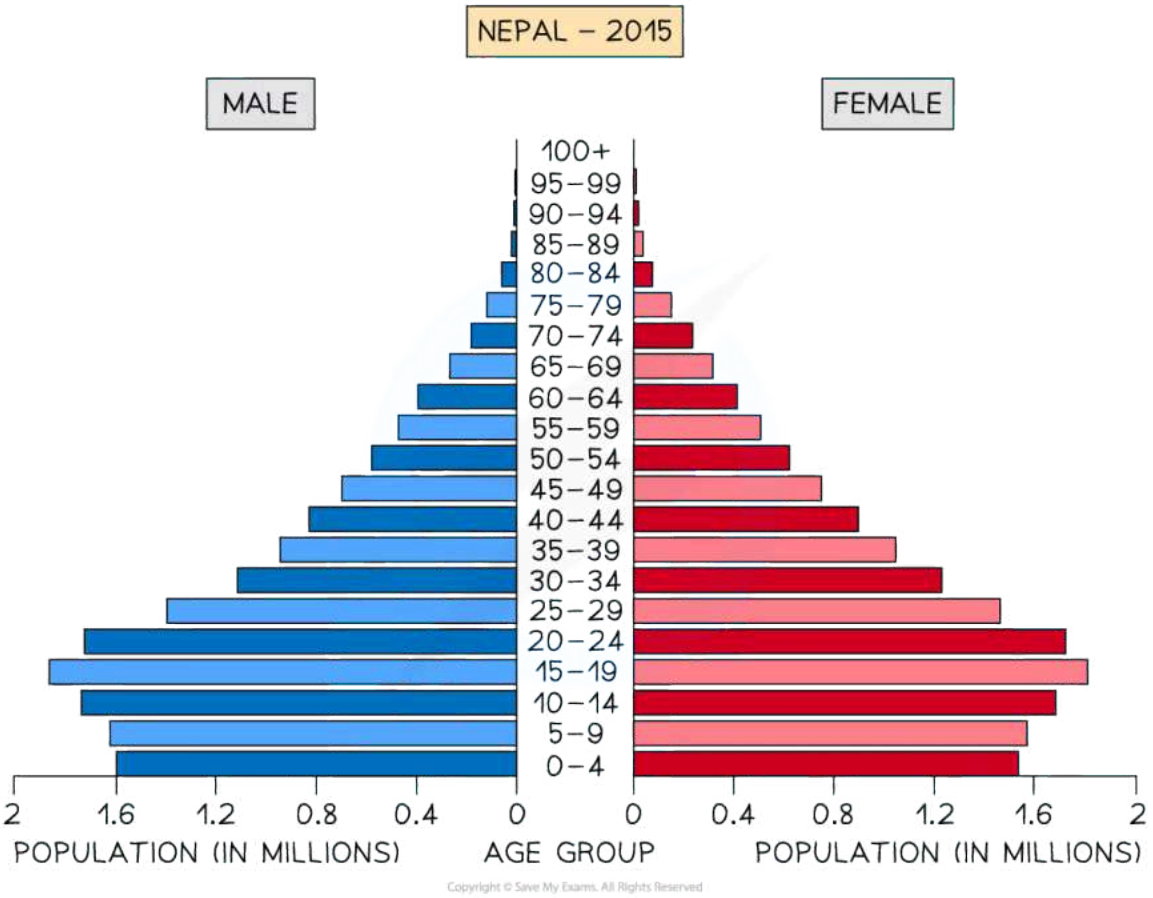
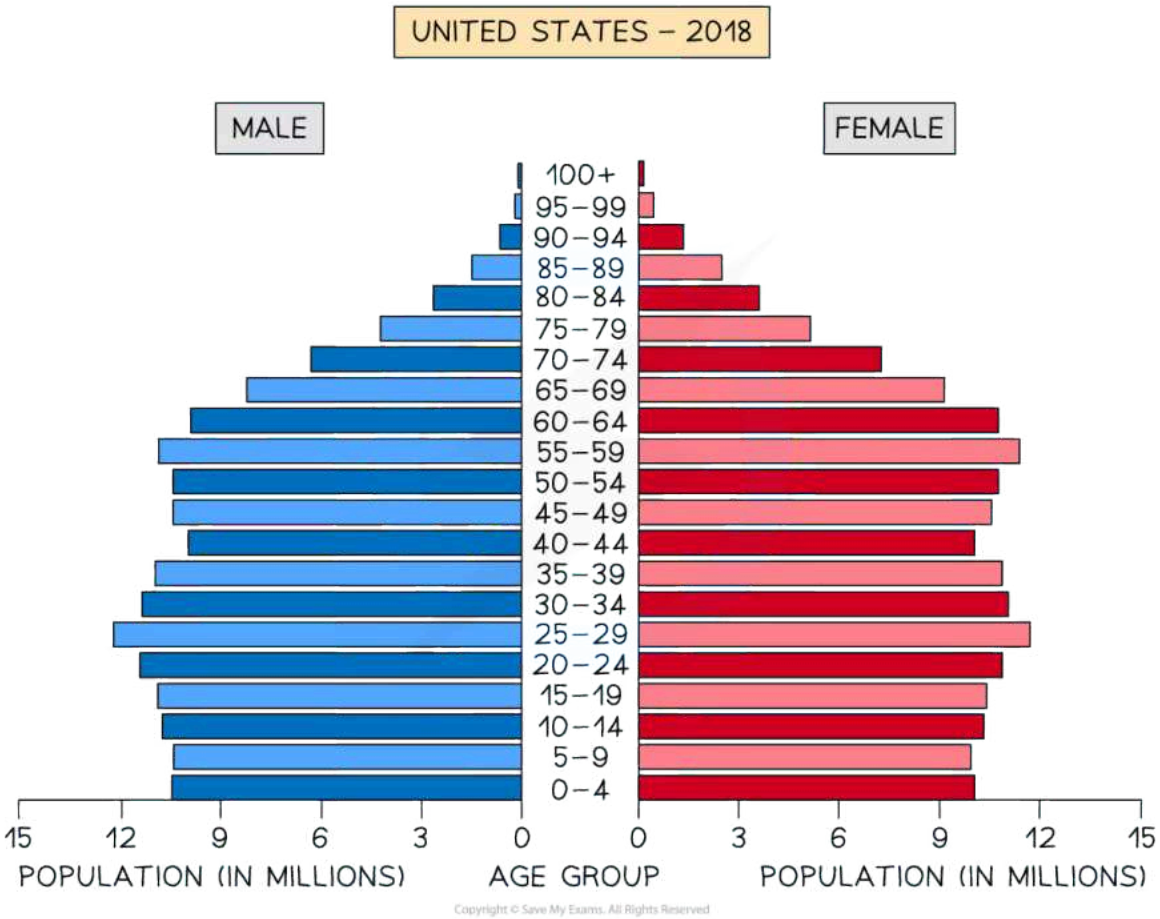


Age–sex pyramid for Nepal

- **More developed LICs** like Nepal typically have a pyramid shape with a taller base, like the one shown above
- This indicates:
  - Decreasing birth rate
  - Increasing life expectancy
  - Decreasing death rate
  - Decreasing infant mortality
  - Decreasing young dependents and increasing economically active population

Your notes



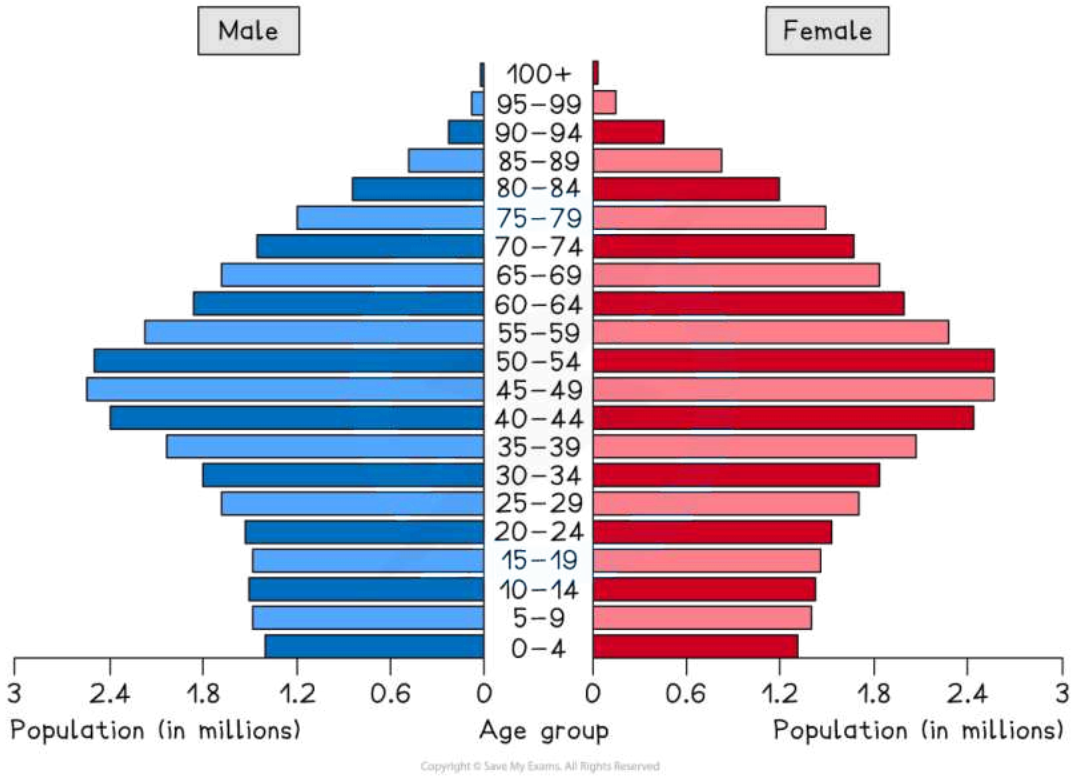
Age–sex pyramid for USA

- **High-income countries** (HICs) such as the USA typically have a column shape
- This indicates:
  - Low birth rate
  - High life expectancy
  - Low death rate
  - Low infant mortality
  - Large working age population

Worked Example

An age-sex pyramid is shown below.

What does the shape of the pyramid tell you about the population structure of the country?



Answer

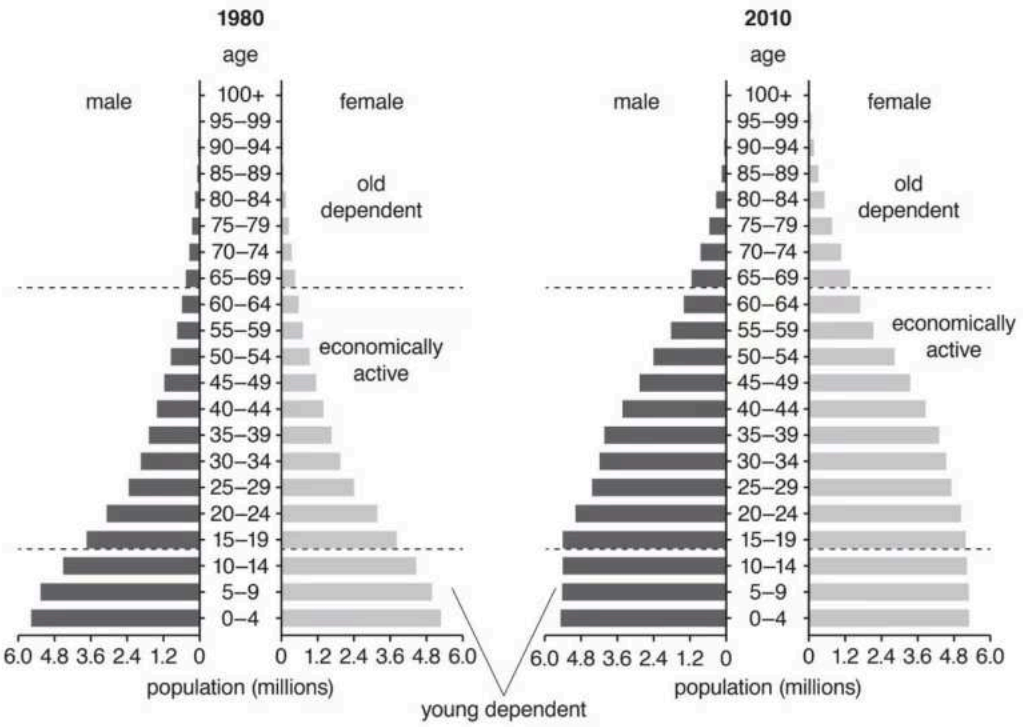
- The narrow base means a low birth rate
- A low birth rate means a low number of young dependents
- A reasonably broad top means high life expectancy
- The majority of the population is between 40 and 60
- This means there will be a large number of elderly dependents in the future

Worked Example

The figure below shows age-sex pyramids for Mexico in 1980 and 2010.

Your notes

Describe the changes in Mexico's population structure between 1980 and 2010.



Answer

- In 2010 there are:
  - More economically active / working / 15–64 year-olds
  - More elderly / old dependents / 65+ year-olds
  - More young dependents in total / bands up to 19 become more even

Examiner Tips and Tricks

Remember—when interpreting an age-sex pyramid, you need to look at four key areas:

- Younger population - is the birth rate high or low?
- Working population - are there enough people of working age to support the young and old dependents?
- Elderly population - is it large or small? (if it is large, then life expectancy is high)

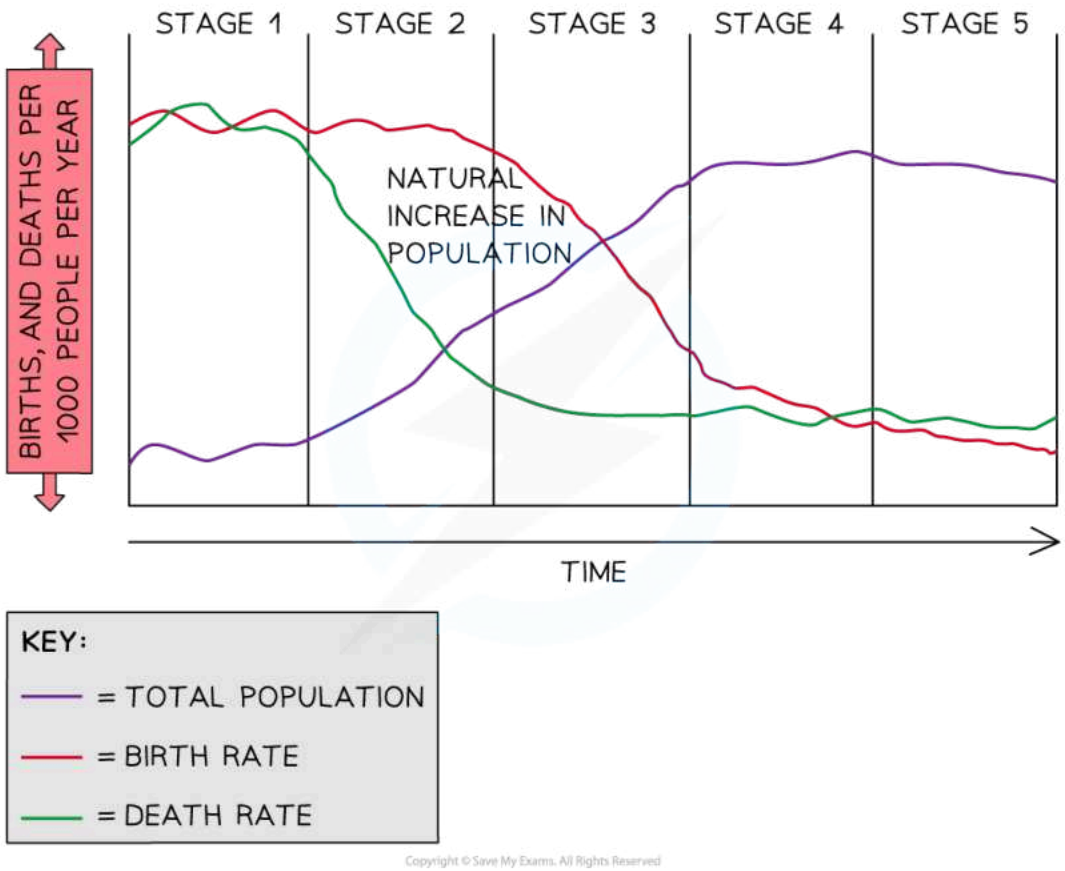
Your notes

- Male/female split - are there any noticeable differences between the numbers of males and females?

Your notes

Demographic transition model (DTM)

- The DTM is a model that shows how a population transitions over time:
  - From a **pre-industrial stage**, with high crude birth rates and high crude death rates
  - To an **economically advanced stage**, with low or declining crude birth rates and low crude death rates
- The DTM illustrates **five generalised stages** that countries pass through as they develop
- It shows how the birth and death rates change and how this affects the overall population of the country



The Demographic Transition Model

Stage 1

- The total population is low
- High birth rates due to lack of contraception and family planning
- High death rates due to poor healthcare, poor diet and famine
- High infant mortality, which leads people to have more children so that some children survive to adulthood

Stage 2

- The total population starts to rise rapidly
- Birth rates remain high as people continue to have large families
- Death rates decrease as a result of improved diets, better healthcare, lower infant mortality and increased access to clean water

Stage 3

- The total population continues to increase but the rate of growth begins to slow
- Birth rate begins to fall rapidly due to increased birth control, family planning, increased cost of raising children and low infant mortality rate
- Death rate still decreasing but at a slower rate as improvements in medicine, hygiene, diet and water quality continue

Stage 4

- The total population is high and is increasing slowly
- Birth rate is low and fluctuating due to accessible birth control and the choice of having fewer children as well as delaying the age women start to have children
- Death rate is low and fluctuating

Stage 5

- The total population starts to slowly decline as the death rate exceeds the birth rate
- Birth rate is low and slowly decreasing
- Death rate is low and fluctuating


Your notes